A Functional Status Assessment Instrument: Validation in an Elderly Population

O. Lynn Deniston and Alan Jette

This study examines the validity of a system of measuring functional status, an important determinant of quality of life. With a group of elderly people who suffer from arthritis, we found that scores in the dimensions of dependence, difficulty, and pain on performance of Activities of Daily Living (ADL) are positively correlated with client reports of joint conditions, ability to deal with their arthritis and attendant problems, and numbers of "good days." Instrument scores do not correlate with professional assessments of clients' joint condition or of their ability to deal with arthritis, although the two professional assessments correlate with each other. Thus it appears that client and professional definitions of joint condition differ; only the clients' definition relates to our measure of functional status.

THERE is continued demand for more effective methods of evaluating the health care of individuals who are subject to chronic disabling disease. In determining the efficacy of a proposed measure, two important considerations are its validity and its reliability.

The validity of a measure may be assumed on the basis of face, content, or definitional validity; a more convincing study may be made on the basis of 1) correlation with other assessments held to be valid measures of the same construct (concurrent validity), or 2) correlation with measures of variables believed on theoretical grounds to be related (construct validity; convergence and discrimination).

Predictive validity is not helpful here, since that is a relational concept. Valid measures of two different concepts must be available before the extent to which the level of one, e.g., diet patterns, "predicts" (or allows study of the relationship with) later scores on another, e.g., blood cholesterol levels.

In reviewing reports of correlations of a given measure with other measures that have been used in the past, one must decide whether his or her purpose is to demonstrate the validity of one set of scores on the basis of a known or assumed relationship with another measure of the same construct (concurrent or construct validity), or to learn what the nature of the relationship is, assuming that both new and old sets of scores are valid (theory building).

Reported new measures of functional status range from those that assume validity on the basis of the way the measure has been developed [1,2] to those whose validity is assessed by studying the relationship of function level with five or six other measures of health or presumed correlates [3,4,5].

This article describes a recently de-

Address communications and requests for reprints to O. Lynn Deniston, Associate Professor, Department of Health Planning and Administration, M4142 School of Public Health II, The University of Michigan, Ann Arbor, MI 48109. Alan Jette is Director of Evaluation Research at the Multipurpose Arthritis Center, Robert B. Brigham Hospital, Boston, MA.

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Figure 1:
PGAP Functional Status Assessment Instrument Items

Mobility	Personal Care	Work
Driving/Other Transportation	Using a Telephone	Employment/Occupation
Shopping	Writing	Using Stove/Oven/Refrigerator
Walking Inside	Cutting Food	Using Sink/Faucets
Walking Outside	Drinking	Reaching Cupboards (High/Low)
Stairs in/to Home	Ability to Wash All Areas	Lifting Pots/Pans
Other Stairs	Turning Faucets	Peeling/Cutting
Curbs	Care of Teeth	Opening Containers
Transferring to/from Bed	Shaving	Doing the Laundry
Transferring to/from Chair	Combing Hair	Sweeping/Mopping
Transferring to/from Car	Washing Hair	Making Beds
Transferring to/from Toilet	Setting Hair	Washing Dishes
Transferring to/from Bath	Putting on and Tying Shoes	Cleaning Bathroom
	Putting on Hose/Pants	Washing Windows
	Putting on Underclothes	Doing Home Repairs
	Putting on Shirt/Blouse	Doing Yardwork
	Buttoning/Zipping	
	Putting on Sweater/Coat	

veloped instrument which was designed to measure the functional status of individuals who have degenerative arthritis, and it presents evidence as to the convergent validity of this measurement technique. An earlier report focused on the instrument's reliability [6], showing that, overall, repeated measurements taken from the same person by different interviewers produced the same score 85 percent of the time.

Background

The Pilot Geriatric Arthritis Project (PGAP) was developed to test the hypothesis that a multidisciplinary health team could function so as to improve the "quality of life" of older adults who suffer from arthritis. The project staff attempted to achieve this aim by using the current technology of arthritis management to effect the coordinated delivery of optimum levels of services to clients. PGAP objectives included prevention of disability, physical restoration, relief of pain, and socioemotional adjustment, all of which are hereafter referred to as functional status. The project was funded by a grant administered by the Regional Medical Programs Service, DHEW. During PGAP's three years of operation, 1,089 clients were served; 75 percent were female, and the mean client age was 69 years [7].

As part of the evaluation component of PGAP, we sought to develop better methods of measuring functional status as a means of judging the impact of the care we delivered to the program's clients. Building on past work in this area [8,9], the PGAP staff devised a technique of measuring three dimensions of functional status—dependence, pain, and difficulty—for 44 different activities of daily living (ADL), which were later assigned to three groups.

To measure the degree of functional dependence, we asked clients to describe the assistance they needed for the usual performance of each ADL over the prior two weeks. Scores were assigned as follows: 0 = independent, 1

= uses mechanical assistance, 2 = uses human assistance, 3 = uses both mechanical and human assistance, and 4 = cannot perform the activity even with maximum assistance. The overall score for dependence was the average score for all relevant ADL. Scores for degree of pain and difficulty, respectively, were assigned on a 4-point scale which ranged from 1 = no pain/difficulty, 2 = mild pain/difficulty, 3 = moderate pain/difficulty, and 4 = severe pain/difficulty. Overall scores, again, were the average for all relevant ADL. For all three dimensions of functional status, data were collected from client self-reports in personal interviews.

Methods

To what extent do the scores obtained from the PGAP instrument truly assess functional status? Initially, we assessed the quality of the PGAP instrument on face validity by inspecting the number and nature of the items. Soon after we began to compare the judgments of the project staff with the instrument scores for a pilot group of clients. It was the consensus of the PGAP staff that the instrument ranked clients in a manner that was similar to their clinical judgment. In the third program year we decided to assess the validity of the PGAP functional status instrument more systematically by comparing instrument scores with other measures with which we hypothesized a correlation. The standard PGAP assessment protocol for intake, and for three- and six-month followup was expanded to incorporate these additional data from clients and clinical staff.

After they had completed the standard PGAP assessment protocol, we asked clients three additional questions which, according to our hypothesis, would tap related dimensions of client status:

1. Overall, how would you rate the condition of your joints; would you say excellent, good, fair, or poor?
2. Overall, how would you rate your ability to deal with your arthritis and the problems it causes; would you say excellent, good, fair, or poor?
3. How many "good days"have you had out of the last seven? (The client was asked to interpret words such as "condition" and "good days" in his or her own terms.)

We also hypothesized that two measures which are traditionally used in arthritis clinical drug studies—grip strength and duration of morning stiffness—would also relate positively to PGAP instrument scores. These items appear in this report.

We collected additional data from each client's "advocate"—the staff member who was responsible for coordinating his or her treatment program. Advocates were asked the following questions:

1. Overall, how would you rate the client's joint status; would you say excellent, good, fair, or poor?
2. Overall, how would you rate the client's ability to deal with his arthritis and the problems it causes; would you say excellent, good, fair, or poor?

These advocate assessments were made independently of client followup interviews, within two weeks of the time of the client interview.

Ninety-five clients entered this preliminary study; 64 of the 95 completed the three-month followup interviews and 54 participated in the six-month followup, giving us a total of 213 assessments. The smaller numbers of three- and six-month followup inter-

Table 1:
Correlations between Clients' Judgments of Condition of Their Joints and of Their Ability to Deal with Arthritis, and Instrument Scores by Time of Assessment

Joint Condition

Time of Assessment	N	Instrument Dimensions: Dependence	Difficulty	Pain	Total Status
Combined	196	0.32†	0.33†	0.37†	0.39†
Program Entry	78	0.24*	0.27*	0.36†	0.34†
3-Month Followup	64	0.40†	0.29*	0.27*	0.38†
6-Month Followup	54	0.42†	0.48†	0.44†	0.45†

Ability to Deal

Time of Assessment	N	Instrument Dimensions: Dependence	Difficulty	Pain	Total Status
Combined	192	0.18*	0.28*	0.20*	0.24*
Program Entry	76	0.13	0.11	0.02	0.07
3-Month Followup	63	0.31*	0.43*	0.20	0.34*
6-Month Followup	53	0.26	0.33*	0.28*	0.38*

*$p<0.05$

†$p<0.01$

views are due to late entry of clients into the program rather than their failure to make scheduled assessments. The additional professional data are available for only 174 of the 213 client assessments; we failed to collect advocate assessments when there were scheduling difficulties, heavy work loads, or other inconveniences of the sort commonly experienced in a community-based service program.

Results

The findings will be presented in two parts: 1) comparison of the scores we obtained by using the instrument with data from the additional client questions, and 2) comparisons between the instrument scores and the professional data. The scores on functional status include a measure of each of the three dimensions—dependence, pain, and difficulty—and an overall average, called "status." The directions and magnitudes of the relationships we hypothesized were calculated with Spearman's Rank Correlation Coefficient (Rho).

Comparison of Instrument Score with Client Assessment

The most direct comparison is the comparison between the instrument scores and clients' overall assessments

Table 2:
Correlations between Number of "Good Days" and Instrument Scores for All Clients, and Separately by Whether "In Dumps" or Not

Instrument Dimensions	All Clients ($N=157$)	Clients Reporting "In Dumps" ($N=59$)	Clients Reporting "Not In Dumps" ($N=97$)
Total Status	0.40*	0.44*	0.47*
Dependence	0.14	0.07	0.09
Difficulty	0.41*	0.44*	0.49*
Pain	0.46*	0.57*	0.51*

*$p<0.01$

of joint status. The direction and magnitude of the relationship ranges from 0.24 to 0.48 at entry, three-month and six-month followup interviews, and overall; all correlations are significantly greater than zero ($p<0.05$). (See Table 1.)

The correlations between a client's assessment of his "ability to deal" with his arthritis and the instrument scores is also shown in Table 1. There is a statistically significant positive correlation between each instrument score and client assessment of ability to deal with arthritis, when all observations are analyzed together. While these two measures were *not* related at the time of intake into PGAP, they showed a consistent positive relationship at three- and six-month followup.

The third comparison measure we used was the client's report of the number of "good days" in the preceding week. The degree of correlation between this criterion and the instrument scores is positive and of moderate magnitude for all instrument dimensions: dependence, 0.31; difficulty, 0.48; pain, 0.43; and overall status, 0.50 (as reported in the first column of Table 2).

Two measures were added in an attempt to achieve greater "objectivity," morning stiffness and grip strength. The instrument score correlations with client reports of "duration of morning stiffness" were 0.05, 0.14, 0.01, and 0.08 with the dimensions of dependence, difficulty, pain, and overall status, respectively. We had based our hypothesis of a modest positive relationship on prior experiences with drug trials, where a reduction in morning stiffness was believed to indicate benefit; we found no association between the two measures, however.

A similar result appeared when we compared the measure of "grip strength" with the instrument scores. Separate correlations for those who report arthritis involving the hands show that this measure bears only a weak relationship to the instrument scores. (See Table 3.) The largest correlation is that between "grip strength" and degree of reported functional difficulty; there are no differences in dependence or pain correlations between measures obtained from those with and without hand involvement.

Comparison of Instrument Scores with Professional Subjective Assessments

In comparing the professional assessments with the instrument scores we analyzed the data supplied by each of

Table 3:
Correlations between Instrument Scores and Grip Strength for All Clients, and Separately for Those Clients with Hand Involvement*

	All Clients ($N=184$)		Clients with "Hand Involvement" ($N=41$)	
Instrument Dimensions	Right Hand	Left Hand	Right Hand	Left Hand
Total Status	–0.06	–0.05	–0.20	–0.17
Dependence	–0.09	–0.08	–0.12	–0.11
Difficulty	–0.08	–0.07	–0.26	–0.24
Pain	–0.02	–0.03	–0.07	–0.05

*No correlations statistically significant at $p<0.05$.

Table 4:
Correlations between Instrument Scores and Professional Assessments of Condition of Joints, for All Raters Combined, and Separately by Discipline

		Instrument Dimensions			
Professional Assessment of Condition of Joints	***N***	**Dependence**	**Difficulty**	**Pain**	**Total Status**
All Raters Combined	169	0.11	0.11	0.22*	0.20†
Health Care Assistant	29	0.01	0.00	0.12	0.03
Nurse	44	0.31*	0.19	0.19	0.25
Occupational Therapist	32	0.16	0.30	0.26	0.31
Physical Therapist	29	1.28	0.06	0.07	0.14
Social Worker	35	0.11	0.30	0.56*	0.35*

*$p<0.05$
†$p<0.01$

five staff members separately; we used data taken from a nurse, an occupational therapist, a physical therapist, a social worker, and a health care assistant, and we combined the data obtained from them as a group. Physician comparisons are not available, since project physicians were not assigned as advocates for any of these clients.

Table 4 displays the direction and magnitude of the relationship between professional assessment of client joint status and the instrument scores. The correlations are low and in only three of twenty cases, by discipline, is the relationship statistically significant. However, in two of the four combined professional comparisons the positive

Table 5:
Correlations between Professional Assessments of Clients' Ability to Deal with Arthritis and Instrument Scores by Time of Assessment

Time of Assessment	N	Instrument Dimensions: Dependence	Difficulty	Pain	Total Status
Combined	173	–0.09	0.08	0.14	0.04
Program entry	82	0.02	0.06	0.03	0.00
3 months	55	–0.14	0.06	0.05	–0.04
6 months	36	–0.09	0.09	0.30	0.09

relationship is small but statistically significant; in no case was a negative relationship observed. This same conclusion is reached if the relationships between all professional assessments and the instrument scores are compared separately at intake and at three and six months.

We had also hypothesized a positive association between professional assessments of a client's "ability to deal" and the instrument scores. As can be seen in Table 5, however, the observed correlations between professional assessments of "ability to deal" and instrument scores are essentially zero; this absence of a relationship remains when the correlations are calculated separately by profession.

A summary of the relationships within and across client and professional subjective assessments is presented in Table 6. Note the substantial and consistently positive relationships between assessments of joint status and "ability to deal" within the ratings of clients,[a] and within those of professionals.[b] We find a similar association between ratings of "ability to deal" across the two groups,[c] and a positive association between client assessment of joint status and professional assessment of the client's "ability to deal" with his or her arthritis.[d] There is, however, a comparatively small association between ratings of joint condition across the two groups[e] and between professional assessment of joint condition and clients' assessment of their "ability to deal."[f] (Superscripts identify sets of correlations in Table 6.)

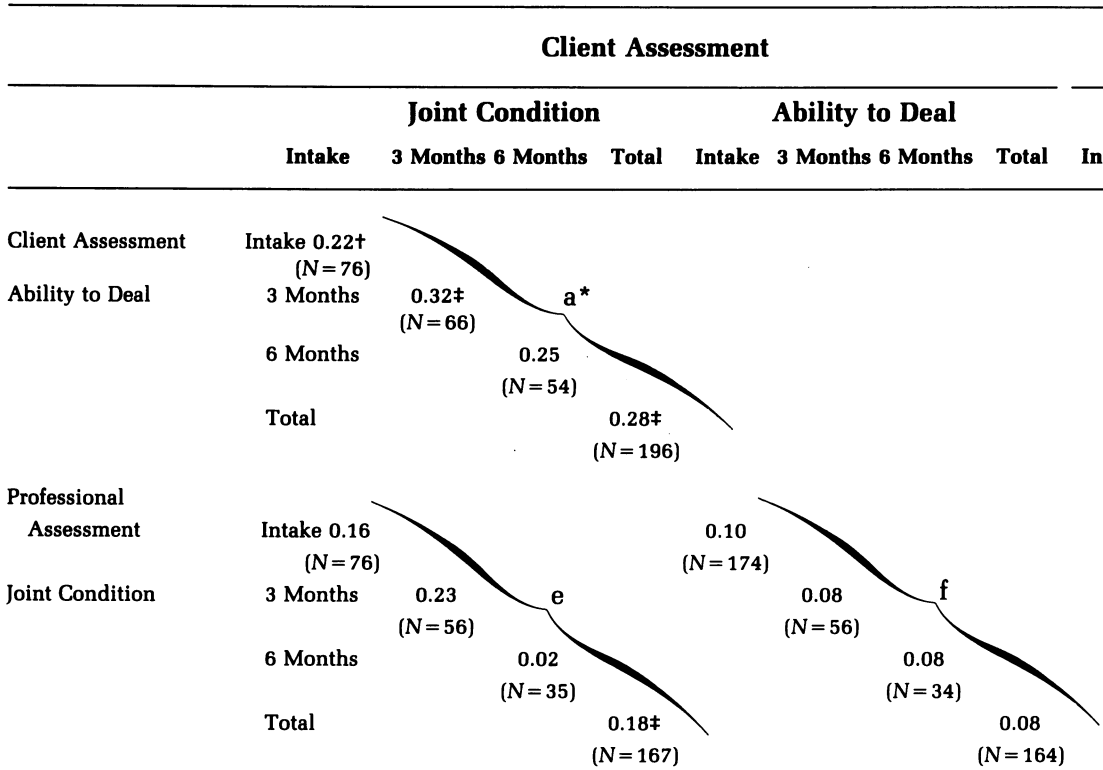
Finally, overall correlations for the four instrument scores and the seven other measures with each of the others are presented in Table 7.

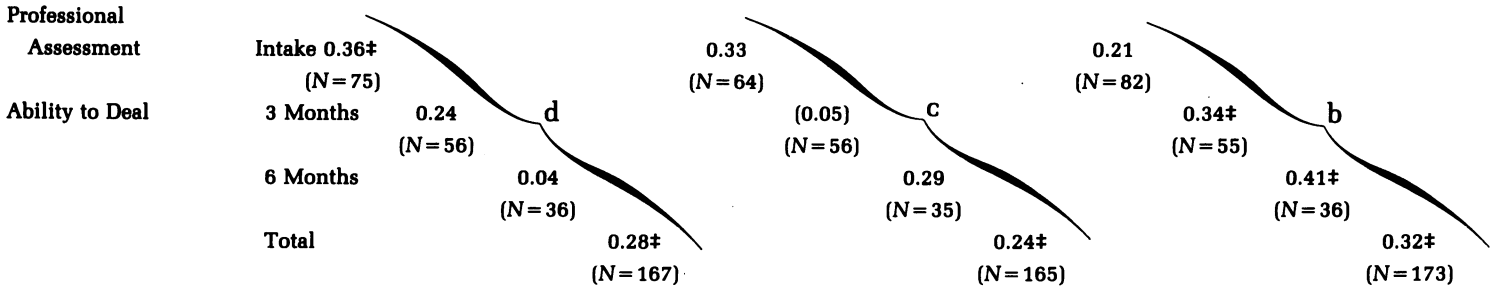
Discussion

There is a consistent, moderate, positive relationship between clients' subjective assessments of their condition and the PGAP instrument scores. We believe this overall assessment by the client to be the best criterion for assessing validity available at this time.

We found little correlation between clients' assessments of their ability to deal with their arthritis and the instrument scores at intake into the program. This finding may be explained as follows: a new client's disability may have been steadily, but slowly, worsening, due to the progressive nature of osteo-

Table 6:
Correlations among Client and Professional Ratings of Joint Condition and of Ability to Deal with Arthritis, by Time of Assessment





*Designations a–f are referred to in the text.

†$p<0.05$

‡$p<0.01$

Table 7:
Overall Correlation Matrix of All Measures of Functional Status*

	Client Assessment				Professional Assessment			
	Joint Condition	Ability to Deal	"Good Days"	Grip Strength	Morning Stiffness	Joint Condition	Ability to Deal	Average†
Instrument Scores								
Dependence	0.32	0.18	0.15	0.12	0.06	0.11	–0.09	0.12
Difficulty	0.33	0.26	0.41	0.26	0.14	–0.11	0.08	0.20
Pain	0.37	0.20	0.46	0.07	0.01	–0.22	0.14	0.15
Joint Condition	0.39	0.24	0.40	0.20	0.08	0.20	0.04	0.22
Average‡	0.35	0.22	0.36	0.16	0.07	0.00	0.04	0.17
Client Assessment								
Ability to Deal	0.28							
Good Days	0.30	0.23						
Grip Strength	0.22	0.03	0.05					
Morning Stiffness	0.05	0.19	0.23	0.10				
Professional Assessment								
Joint Condition	–0.18	–0.08	0.09	0.04	0.09			
Ability to Deal	0.28	0.24	0.25	0.16	0.12	0.32		
Average§	0.16	0.15	0.19	0.10	0.13	0.05	0.18	

*Signs adapted to direction of hypothesis: a negative correlation indicates a relationship opposite to that which we expected.
†Average correlation with 7 other measures.
‡Average correlation with 4 scores.
§Average correlation with 6 other measures.

arthritis. This almost imperceptible rate of change in the status of the disease, and the seemingly limited benefit of therapeutic intervention, contribute to this independence of the client's perception of "ability to deal" and of functional level. An increase in client awareness of functional status, because of client perception of a change in status, or perhaps because of information gained as a result of contact with other clients or services received from PGAP, might also change a client's perception of his or her ability to deal with the arthritis. Thus, a change in perceived functional status could produce a greater correspondence between the two measures.

Support for this interpretation is found when clients' scores are stratified according to the answers they give at the time of program entry, to the question, "Are your arthritis symptoms getting worse lately?" Of the 76 clients who supplied data on all three questions, 40 reported a worsening and 36 reported no worsening of arthritis symptoms. The correlations between perceived "ability to deal" and the instrument scores, stratified by "worsening of symptoms," are in the predicted direction. Although no correlation achieves statistical significance, there is a consistent trend toward a positive relationship between instrument scores and client perception of "ability to deal" when a change occurs.

The measure of client perception of the number of "good days" may be more comprehensive than the instrument scores of dependence, difficulty, and pain, and may include elements of emotional or mental function. To test this hypothesis, we correlated the scores on client perception of "good days" separately for those answering "yes" and "no" on an additional question: "Do you feel 'down in the dumps' often?" The correlations for those clients "in" and "not in" the dumps are reported in Table 2. The lesser correlation for dependence, and the stronger correlation between this measure and the dimensions of functional pain and difficulty when "in dumps" is controlled, are noteworthy. They suggest that the pain and difficulty aspects of arthritis are related not only to physical function, but to psychological status as well.

In contrast to this first finding, we found little or no correlation between the instrument scores and professional subjective assessments of clients' joint condition. This lack of correlation of the instrument scores with professional assessments might be attributed to 1) the possibility that the questions professionals were asked did not produce direct answers concerning the client's functional status; 2) the possibility that our health professionals were not able to make such assessments; or 3) the possibility that professional and client perceptions of status are indeed different.

The first explanation was suggested by the study of Convery and others [8], who report a high (0.81) correlation between physician assessments and scores from a very similar instrument, where professionals were asked specifically to rank clients' functional ability. In our study, professionals were asked to judge a client's "joint condition" and "ability to deal" with arthritis; these terms may have been interpreted by the professionals to mean something other than functional ability. Although each may be a valid measure of some narrow aspect of client status, they are clearly measuring different aspects of the client's condition. It would help to identify the meanings of the constructs "joint condition" and "ability to deal with arthritis and the problems it causes" as defined by health professionals.

On the other hand, if one considers the third explanation we have sug-

gested, the question then becomes, "Which assessment is more valid, client or professional?" Acheson and Ginsburg [11], in a study of arthritis in a general population, found a positive relationship between x-ray evidence of arthritic joint changes and client self-report of difficulty in performing ADL tasks for women, but not for men. Although this positive correlation between an "objective" measure of effects of arthritis and client reports argues for the validity of client assessments, we did not replicate such a relationship with our assessment of grip strength. The available data do not yet allow us to answer this interesting and provocative question; that task remains for future research.

Inspection of the data summarized in Table 7 reveals the very low correlations among several measures that are conventionally used to assess health services, including overall clinical impressions and two "objective" measures commonly used in programs dealing with rheumatic diseases. This finding may be due to the fact that the overwhelming majority of PGAP clients had osteoarthritis, while the measures of morning stiffness and grip strength have been used most commonly in studies of rheumatoid arthritis.

The magnitude of the correlations in Table 7 suggests that the proposed dimensions of the PGAP instrument—dependence, pain, and difficulty—are indeed distinct concepts. Correlations of the instrument scores with some subjective measures differed across these dimensions. The correlations between client reports of the number of "good days" and the dimensions of functional pain and difficulty were greater than they were between the first measure and the dimension of functional dependence. The strongest correlation between grip strength and the instrument was in the dimension of functional difficulty. On the other hand, the correlations across dimensions of functional status were essentially the same for client assessment of joint condition and "ability to deal." Thus, this preliminary evidence suggests that the distinction between dependence and the other two dimensions is meaningful; the proposed distinction between functional pain and difficulty is still equivocal.

One might ask, if clients' overall assessments of their joint conditions, or their reports of the number of "good days" have validity, why use a long interview, collecting data on three dimensions for 44 different, specific activities? If an instrument is designed to be used as a measure of the impact of health intervention, it must be precise enough to be sensitive to functional areas where change is anticipated to occur, and the magnitude of the changes. While global measures are useful as a means of assessing the validity of a more precise instrument, as we have demonstrated in this study, these same global measures may not help to assess changes in functional status. Thus, their utility as evaluation instruments is limited: the need for a precise measure of functional status remains. One type of improvement may be possible. Further analysis of the PGAP instrument has shown that the original 44 functional items can be reduced to six distinct clusters of functional activities: basic movement, transfers, gross mobility, self-ease, cooking, and housecleaning chores [12]. Measurement of a few functional items from each cluster could substantially reduce the length of the interview without greatly reducing the precision of the assessment. The more comprehensive protocol would need to be applied only to clients who are identified as needing service.

Conclusions

The functional status assessment instrument we have described here is a refinement and expansion of the Patient

Classification for Long Term Care [10], which yields only data about reported degree of independence in the performance of major categories of ADL. In addition to increasing the number of functional areas assessed, we generated a scoring system to summarize the observations. We have demonstrated that these scores do correlate with clients' global assessments of the condition of their joints and of their ability to deal with arthritis and disease-related difficulties; we accept this as evidence of validity.

We suggest that the measure we called functional status encompasses more than performance alone; this assumption is inherent in most other ADL assessment instruments. We find that scores of reported difficulty and pain on function also correlate with clients' global assessments; nevertheless, the correlations for these dimensions differ enough from those for performance to suggest that they represent different aspects of functional status. Further research is needed to establish whether the three purported dimensions of function—dependence, difficulty, and pain—are, indeed, distinct and exhaustive aspects of the concept of functional status. There would then be a need for additional work to refine and validate scoring mechanisms so as to generate those that produce interval or ratio level of measurement.

If our argument for the need to measure separate functional dimensions is confirmed, policy makers will need to consider the relative value of each of these dimensions and the potential effect on each in order to generate and analyze alternative interventions. For example, a manager may propose one intervention that could reduce functional difficulty and pain for each member of a target group, even though he or she anticipates no benefit in the direction of functional independence. An alternative intervention may be considered with the expectation that it would improve functional independence for half the group, but with no expected benefit in the direction of alleviating difficulty or pain. Such alternatives cannot be analyzed with current measures, nor can actual intervention efforts be evaluated with current measures of ADL performance. Such evaluations could, however, be made with instruments such as those we have described here. Thus, we recommend the functional status assessment instrument for consideration in future health intervention studies where functional status is of interest.

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REFERENCES

1. Kane, R.L. et al. Measuring outcomes of care in an ambulatory primary care population. *Journal of Community Health* 1(4):223, Summer 1976.
2. Granger, C.V. and D.S. Greer. Functional status measurement and medical rehabilitation outcomes. *Archives of Physical Medicine and Rehabilitation* 57:103, Mar. 1976.
3. Reynold, W.J., W.A. Rushing, and D.L. Miles. The validation of a function status index. *Journal of Health and Social Behavior* 15(4):271, 1974.
4. Bergner, M. et al. The sickness impact profile: Validation of a health status measure. *Medical Care* 14(1):57, Jan. 1976.

5. William, R.G.A. et al. Disability: A model and measurement technique. *British Journal of Preventive Social Medicine* 30(2):71, 1976.
6. Jette, A.M. and O.L. Deniston. Inter-observer reliability of a functional status assessment instrument. *Journal of Chronic Diseases* 31(9/10):573, 1978.
7. Duff, I.F. and J. Neukon. Final report: The Pilot Geriatric Arthritis Program. Unpublished paper submitted to the Wisconsin Association for Regional Medical Programs, Sept. 1977.
8. Jones, E., B. McNitt, and E. McKnight. *Patient Classification for Long Term Care: User's Manual.* DHEW Pub. No. (HRA) 75–3107. Washington, DC: U.S. Government Printing Office, Nov. 1974.
9. Katz, S. et al. *Effects of Continued Care: A Study of Chronic Illness in the Home.* DHEW Pub. No. (HSM) 73–3010. Washington, DC: U.S. Government Printing Office, Dec. 1972.
10. Convery, F.R. et al. Polyarticular disability: A functional assessment. *Archives of Physical Medicine and Rehabilitation* 58:494, Nov. 1977.
11. Acheson, R.M. and G.N. Ginsburg. New Haven survey of joint diseases XVI: Impairment, disability and arthritis. *British Journal of Preventive Social Medicine* 27(3):168, 1973.
12. Jette, A.M. An empirical approach to evaluating functional capacity. *Archives of Physical Medicine and Rehabilitation*, 1979 (in press).